Investigation of Nanometal/Carbon Fiber Composite Structures for Use in Novel Lightweight Cryotank Designs, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

This proposal seeks to investigate the use of a novel high strength nanostructured metal (Nanovate

TM

) as a thin structural reinforcing shell on ultra-lightweight carbon fiber reinforced plastic (CFRP) propellant and cryogenic storage tanks. In the proposed project, Integran seeks to address the intrinsic deficiencies of CFRP by applying nanometal to the inside liner of the CFRP cryogenic storage tanks to provide a high strength pressure barrier with excellent mechanical performance and damage tolerance at cryogenic temperatures, thereby enabling the use of CFRP for cryogenic storage tanks. In addition, the nanometal liner will also provide increased surface durability, wear resistance and specific strength/stiffness of the CFRP substructure at cryogenic, ambient and elevated temperatures (temperatures at which conventional composites begin to soften). The high strength of the nanostructured material will allow a thin structural reinforcing coating, thus maintaining the overall lightweight nature of the component. The successful execution of this project will provide a proof-of-concept demonstration as well as baseline mechanical property data for nanometal/composite hybrid structures at a range of temperatures, thereby allowing engineering designers to incorporate the use of these structures into advanced engineering components, including cryogenic storage tanks.

Anticipated Benefits

The technology also has applicability to more conventional pressure vessels such as fireman's air tank or gas storage cylinders. While fiber reinforced plastics composites have incredible strength to weight characteristics, there are many potential applications which would benefit from a hard nanostructured metallic coating for wear resistance, reflectivity, EMI shielding, hardness, damage resistance, material compatibility. Additional markets which may benefit from the use of a nanometal/FRP composite include: sporting goods, defense, automotive, consumer goods and electronics. The proposed technology has application within NASA for use with cryogenic storage tanks, composite overwrapped pressure vessels, satellite propellant tanks. The proposed Nanometal/Composite hybrid structures also have applicability to where composite structures require enhanced functionality such as: wear resistance, reflectivity, EMI shielding, hardness, damage resistance, material compatibility.

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Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3

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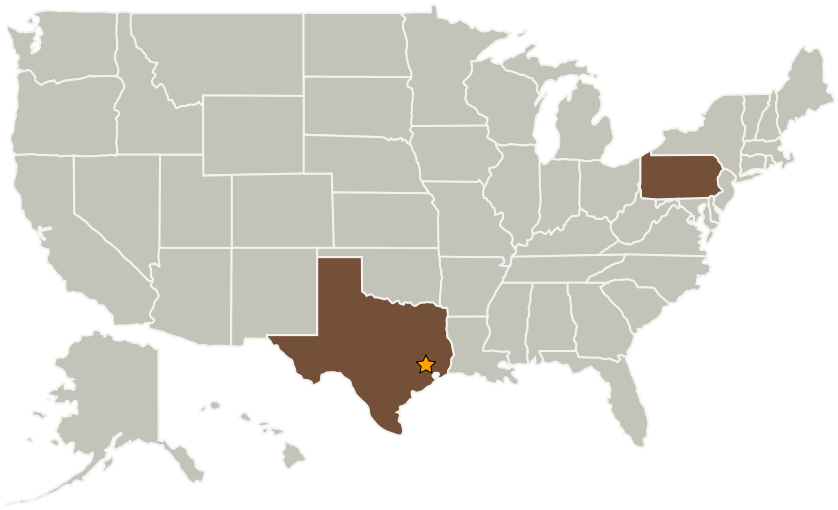
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Integran Technologies USA, Inc.	Supporting Organization	Industry	Pittsburgh, Pennsylvania

Primary U.S. Work Locations	
Pennsylvania	Texas

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

David M Ray

Principal Investigator:

Robert Heard

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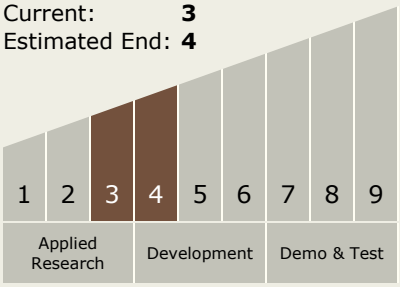
Completed Technology Project (2009 - 2009)

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.1 In-space Propellant Storage & Utilization